Discharge lamp

The invention relates to a high-pressure discharge lamp.

High-pressure discharge lamps ranging from 35 to 150 W have become a dominant player in lighting retail applications. Trends have emerged which create positive conditions for range extensions towards lower lumen packages and/or lower wattages. Lower light levels are being used, for instance in exclusive shops, focusing the light on the goods instead of flooding the area. End users in the market become more and more interested in a uniform quality of the light and would prefer to employ high-pressure discharge lamps instead of using halogen lamps for the low lumen packages and accent lighting.

Generally, high-pressure discharge lamps of the kind mentioned in the opening paragraph either have a discharge vessel with a ceramic wall or have a quartz glass discharge vessel. Such high-pressure discharge lamps are widely used in practice and combine a high luminous efficacy with favorable color properties. The discharge vessel of the lamp contains one or several metal halides in addition to Hg and a rare gas filling.

A ceramic wall of a discharge vessel in the present description and claims is understood to be a wall made from one of the following materials: monocrystalline metal oxide (for example sapphire), translucent densely sintered polycrystalline metal oxide (for example Al2O3, YAG), and translucent densely sintered polycrystalline metal nitride (for example AlN).

A lamp of the kind mentioned in the opening paragraph is known from the English abstract of JP-A 04 002 035(1992). The known discharge lamp comprises a discharge vessel and current supply conductors supporting the discharge vessel while installed projectively at a lamp base of an insulating material. An outer bulb of which one end is left open is fixed to the lamp base enclosing the discharge vessel and the current supply conductors.

In the known lamp each lead through conductor is connected to its respective current supply conductor by means of an additional conducting metal strip separately fastened to each of the both conductors. Suitable ways of fastening are resistance welding,

clamping, crimping and combinations. The thus formed construction is complicated, which makes it vulnerable to production faults resulting in production loss. This is a drawback.

The invention has for its object to counteract the draw back above indicated. According to the invention the high-pressure discharge lamp comprises:

an outer bulb (1) in which a discharge vessel (11) is arranged around a longitudinal axis (22),

the discharge vessel enclosing, in a gastight manner, a discharge space (13) provided with an ionizable filling,

the discharge vessel having a first (2) and a second (3) mutually opposed portion comprising a first and a second leadthrough through which a first (40) and a second (50) leadthrough conductor, respectively, extend to a pair of electrodes (6,7) arranged in the discharge space,

a lamp base (8) of electrically insulating material supporting the discharge vessel via a first (4) current supply conductor, having a weld (41) with the first leadthrough conductor, and a second (5) current supply conductor electrically connected to the second leadthrough conductor, together forming a respective first and a second current path to the pair of electrodes,

the lamp base also supporting the outer bulb,

the outer bulb enclosing the first and second current supply conductors,

the outer bulb being connected to the lamp base in a gas-tight manner,

the lamp base being provided with first (14) and second (15) contact members connected electrically to the respective first and second current supply conductor.

In an advantageous embodiment the first current path of the 1st current supply conductor and the 1st leadthrough conductor has

a 1st section (A) extending from the 1st leadthrough along the longitudinal axis towards the lamp base,

a 2nd section (B) bended away extending effectively traverse to the longitudinal axis, and

a 3rd section (C) extending towards the first contact member.

Preferably the 2nd section of the first current path comprises two U-bends (UB1, UB2). Preferably each U-bend is lying in a mutual different plane. In a further embodiment the two U-bends are separated by an intermedate part (BS), for instance a straight part. Alternatively

the two U-bends form part of a helix. By using mutual different planes for the U-bends further miniaturization of the lamp construction is promoted.

In a further prefered embodiment of a lamp according to the invention the weld of the 1st current supply conductor with the 1st leadthrough conductor is in the 3rd section of the 1st current path. The shaping of the current path then substantially takes place by the leadthrough conductor, which is chosen to have a thermal expension coefficient matching to the ceramic wall material. Suitable materials like Nb, Mo and Zr also posses a reasonable to high degree of ductility, which is advantageous for shaping and in absorbing differences in thermal expansion between the leadthrough conductor and the current supply conductor.

The weld of the 1st current supply conductor with the 1st leadthrough conductor is preferably a butt-weld. A particular advantage of the construction with a butt-weld is the suitability of a butt-weld to be formed in an oxidizing atmosphere, like air. Thus lamp fabrication can be kept relative simple without the need of a special controlled atmosphere during the mounting process of the discharge vessel on the base plate.

Generally in the leadthrough the leadthrough conductor is sealed to the discharge vessel wall by means of a sealing frit, which tends to creep over the conductor surface for some length. By selecting the 1st section of the 1st current path to have a length of at least 1mm, preferably about 2mm the location of the bending of the conductor in forming the 2nd section will then be free of sealing frit.

The invention will be explained in more detail with reference to a drawing (not to scale) in which:

Fig. 1 diagrammatically shows a high-pressure discharge lamp according to the invention,

Fig. 2 a cross-section of the lamp as shown in fig. 1, and

Fig. 3 shows in detail a part of current supply conductor construction of the lamp of figure 1.

Figures 1 and 2 show a high-pressure discharge lamp according to the invention, which comprises:

an outer bulb 1 in which a discharge vessel 11 is arranged around a longitudinal axis 22,

the discharge vessel enclosing, in a gastight manner, a discharge space 13 provided with an ionizable filling,

the discharge vessel having a first 2 and a second 3 mutually opposed portion comprising a first and a second leadthrough through which a first 40 and a second 50 leadthrough conductor, respectively, extend to a pair of electrodes 6,7 arranged in the discharge space,

a lamp base 8 of electrically insulating material supporting the discharge vessel via a first 4 current supply conductor, having a weld 41 with the first leadthrough conductor, and a second 5 current supply conductor electrically connected to the second leadthrough conductor, together forming a respective first and a second current path to the pair of electrodes,

the lamp base also supporting the outer bulb,

the outer bulb enclosing the first and second current supply conductors,

the outer bulb being connected to the lamp base in a gas-tight manner,

the lamp base being provided with first 14 and second 15 contact members connected electrically to the respective first and second current supply conductor.

In the shown embodiment the mutually opposed portions of the discharge vessel through which first and second leadthrough conductors extend, are neck-shaped, which is preferred to have the leadthrough formed by the sealing of the leadthrough conductor to the ceramic material at a location which will stay relatively cool during lamp operation. In the shown embodiment the leadthrough conductors are sealed to the ceramic neck-shaped portions at the end of each neck-shaped portion pointing away from the discharge space by means of a sealing frit (not shown in the drawing) in a way well known in the art. The thus formed fleadthroughs form hermetic sealings of the discharge vessel. Alternative leadthrough constructions are well known in the art, for instance formed by a cermet being gastight sintered to the ceramic end portion. Preferably, an exhaust tube 18 for evacuating the outer envelope 1 is provided in the lamp base 8. In this manner, the outer envelope 1 can be evacuated after the discharge vessel 11 and the outer bulb 1 have been mounted on the lamp base 8. In an alternative embodiment the exhaust tube 18 may also form in the lamp base 8 a feed through tube of one of the current supply conductors to its respective contact member.

In figure 3 a part of current supply conductor construction forming the 1st current path is shown in detail. The first current path has

a 1st section A extending from the 1st leadthrough along the longitudinal axis 22 towards the lamp base,

a 2nd section B bended away extending effectively traverse to the longitudinal axis, and

a 3rd section C extending towards the first contact member.

The 2nd section B of the first current path comprises two U-bends UB1, UB2 separated by an intermedate straight part BS, each U-bend lying in a mutual different plane. In the shown configuration U-bend UB1 is in a plane through the longitudinal axis 22 and U-bend UB2 in a plane substantially traverse to the plane U-bend UB1 is located in.

In the shown embodiment the 1st A, 2nd B and 3rd C sections of the 1st current path are formed by the leadthrough conductor 40. The 3rd section C is welded to the current supply conductor 4 at the butt-weld 41.

A suitable material for use as leadthrough conductor is Nb. It closely matches the thermal expansion rate of ceramic and has a high degree of ductility, which has the advantage that at the one hand the necessary bending as part of the current path will be easily performed and on the other hand has a large absorbing capacity for absorbing differences in thermal expansion between current supply conductor and discharge tube.

A practical embodiment of the lamp described in the drawing has a nominal power of 22W, generating during stable operation light with a color temperature of about 3000K with an efficacy of about 70lm/W. The filling of the discharge vessel comprises 2.2mg Hg and 5.5mg iodide salts of Na, Tl, Dy, Ho and Tm in a mol percentage 85, 9, 2, 2 and 2.

The overall length of the outer bulb and lamp base measured along the longitudinal axis of the lamp is 44mm. The greatest diameter of the outer bulb is 17mm. The length of the discharge vessel inclusive the neck-shaped portions is 28mm. The disharge space has an internal diameter of 4.6mm. Of the 1st leadthrough conductor the 1st section A extending from the 1st leadthrough along the longitudinal axis towards the lamp base has a length of about 2mm.

In an alternative embodiment of a lamp according to the invention the end portions of the discharge vessel incorporating the leadthroughs consist of ceramic disks closing the discharge space.

The shape of the discharge space in the shown embodiment is cylindrical. However, any other shape, like for instance spherical, tapered and combinations, is suitable for application in a lamp according the invention.